Enhanced Water Quality Monitoring and Modeling Program for the A.R.M. Loxahatchee National Wildlife Refuge Quarterly Update Report – September 2014

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Overview

This update is a summary of activities since the previous status report of June 2014 on the implementation of the Refuge's Enhanced Water Quality Monitoring and Modeling Program. A project overview, and other detailed information about the program can be found at: http://sofia.usgs.gov/lox_monitor_model/. The primary objective of this overall program (Brandt et al. 2004) focuses on providing information for use in ecological management of the Refuge (e.g., USFWS 2007a, b; USFWS 2009; USFWS 2010a, b; USFWS 2012a; USFWS 2012b; USFWS 2013; USFWS 2014).

The Refuge's monitoring component of this program also addresses one of the Consent Decree Principals recommendations (17 December 2003):

> ***B. Enhancing Monitoring of the Refuge***
> *Design and implement an enhanced monitoring program to improve spatial and temporal understanding of factors related to phosphorus dynamics.*

Information Availability

Through collaboration with USGS, information from the Refuge's Enhanced Water Quality Monitoring and Modeling Program has been made available on the USGS' SOFIA web site at: http://sofia.usgs.gov/lox_monitor_model/.

Final data for monthly samples through May 2006 are publicly posted on DBHYDRO by the SFWMD at http://my.sfwmd.gov/dbhydroplsql/show_dbkey_info.main_page. Data for June 2006-September 2014 are posted on the Technical Oversight Committee's web site at http://www.sfwmd.gov/toc/. This report includes information from samples collected through September 2014.

Water Quality Data Analyses Update

Primary efforts for this quarter involved exploring mechanisms to continue translating information from the program to aid in Refuge management decisions, and working on the program's Annual Report.

Monitoring Update (July – September 2014)

Sampling of the enhanced water quality monitoring network (**Figure 1**) occurred at 32 stations in July, 37 in August, and 37 in September 2014 (**Table 1**).

Total phosphorus data available to date for October 2013 through September 2014 are presented in **Table 1**. Maps of stations where samples were collected for the months from for July through September 2014 are presented in **Figures 2-4**.

Conductivity sonde deployment information for October 2013 through September 2014 is presented in **Table 2**.

Next Steps

The next steps for this program include additional efforts on the Annual Report, and additional model development and application.

References

Brandt, L.A., Harwell, M., Waldon, M. (2004) Work Plan: Water Quality Monitoring and Modeling for the A.R.M. Loxahatchee National Wildlife Refuge: 2004-2006. Prepared for the A.R.M. Loxahatchee National Wildlife Refuge. April, 2004. 33 pp.

USFWS. (2007a) A.R.M. Loxahatchee National Wildlife Refuge - Enhanced Monitoring and Modeling Program – 2nd Annual Report – February 2007. LOXA06-008, U.S. Fish and Wildlife Service, Boynton Beach, FL. 183 pp.

USFWS. (2007b) A.R.M. Loxahatchee National Wildlife Refuge - Enhanced Water Quality Monitoring and Modeling Program – 3rd Annual Report – October 2007. LOXA07-005, U.S. Fish and Wildlife Service, Boynton Beach, FL. 116 pp.

USFWS. (2009) A.R.M. Loxahatchee National Wildlife Refuge - Enhanced Water Quality Monitoring and Modeling Program – 4th Annual Report – July 2009. LOXA09-007, U.S. Fish and Wildlife Service, Boynton Beach, FL. 106 pp.

USFWS. (2010a) A.R.M. Loxahatchee National Wildlife Refuge - Enhanced Water Quality Monitoring and Modeling Program – 5th Annual Report – September 2010. LOXA08-007, U.S. Fish and Wildlife Service, Boynton Beach, FL. 43 pp.

USFWS. (2010b) A.R.M. Loxahatchee National Wildlife Refuge - Enhanced Water Quality Monitoring and Modeling Program – 6th Annual Report – October 2010. LOXA09-011, U.S. Fish and Wildlife Service, Boynton Beach, FL. 42 pp.

USFWS. (2012a) A.R.M. Loxahatchee National Wildlife Refuge - Enhanced Water Quality Monitoring and Modeling Program – 7th Annual Report – February 2012. LOXA12-001, U.S. Fish and Wildlife Service, Boynton Beach, FL. 115 pp.

USFWS. (2012b) A.R.M. Loxahatchee National Wildlife Refuge - Enhanced Water Quality Monitoring and Modeling Program – 8th Annual Report – October 2012. LOXA12-004, U.S. Fish and Wildlife Service, Boynton Beach, FL. 68 pp.

USFWS. (2013) A.R.M. Loxahatchee National Wildlife Refuge - Enhanced Water Quality Monitoring and Modeling Program – 9th Annual Report – June 2013. LOXA13-001, U.S. Fish and Wildlife Service, Boynton Beach, FL. 71 pp.

USFWS (2014) A.R.M. Loxahatchee National Wildlife Refuge - Enhanced Water Quality Program – 10th Annual Report for calendar year 2013 – June 2014. LOXA14-002, U.S. Fish and Wildlife Service, Boynton Beach, FL. 71 pp.

Table 1. Total phosphorus data (ppb) available for October 2013 – September 2014 from the Enhanced Water Quality Monitoring Program for: (a) marsh, and (b) canal stations for the A.R.M. Loxahatchee National Wildlife Refuge. Graphical representation of station locations are shown in Figure 1.

a) Marsh stations

Marsh Station	Oct-13	Nov-13	Dec-13	Jan-14	Feb-14	Mar-14	Apr-14	May-14	Jun-14	Jul-14	Aug-14	Sep-14
LOXA101	-	9	31	13	14	14	-	-	-	17	17	24
LOXA102	-	5	15	7	9	-	-	-	-	-	10	10
LOXA103	-	7	12	7	11	3	-	-	-	-	8	10
LOXA105	14	14	36	14	15	22	-	-	-	17	15	20
LOXA106	11	7	28	11	9	5	-	-	-	-	9	9
LOXA107	9	U	4	5	7	-	-	-	-	-	8	11
LOXA108	2	2	11	9	6	-	-	-	-	-	5	10
LOXA109	-	7	25	11	9	7	3	-	-	9	8	10
LOXA110	-	2	6	8	5	3	-	-	-	6	7	11
LOXA111	-	2	5	6	5	2	3	-	-	7	8	11
LOXA112	-	6	16	8	5	5	U	-	-	6	6	10
LOXA113	-	U	7	6	4	6	4	-	-	5	7	7
LOXA114	-	U	6	7	6	4	U	-	-	6	9	8
LOXA117	16	17	16	13	17	8	5	-	-	16	15	20
LOXA118	8	8	9	8	10	5	U	8	-	7	7	10
LOXA119	6	8	7	7	6	5	3	U	77	8	9	9
LOXA120	4	4	5	7	6	4	3	U	-	5	5	8
LOXA122	-	13	17	13	15	11	8	-	-	11	13	18
LOXA124	-	10	26	20	23	14	-	-	-	9	17	13
LOXA126	-	13	10	7	7	5	38	-	-	6	6	9
LOXA127	-	7	7	7	5	3	6	-	-	7	6	9
LOXA128	-	U	7	6	5	3	5	-	-	5	6	9
LOXA130	-	6	16	11	17	5	2	-	-	10	14	15
LOXA131	-	3	11	U	3	9	U	-	-	9	7	13
LOXA133	-	15	27	13	21	8	-	-	-	23	30	28
LOXA134	-	8	20	7	9	4	-	-	-	11	14	10
LOXA136	18	14	31	16	19	13	32	-	-	15	28	27
LOXA137	9	8	15	8	11	4	-	-	-	14	13	16
LOXA138	3	U	6	5	3	3	-	-	-	9	8	10
LOXA139	3	U	11	-	3	6	-	-	-	10	9	8
LOXA140	-	6	12	13	5	5	-	-	-	12	15	25
LOXA141	-	10	13	16	11	11	5	U	-	10	11	14
MAX	18	17	36	20	23	22	38	8	77	23	30	28
MIN	2	2	4	5	3	2	2	8	77	5	5	7

U indicates that compound was analyzed, but the concentration was below the minimum detection limit.

Table 1 cont.

b) Canal stations

Canal Station	Oct-13	Nov-13	Dec-13	Jan-14	Feb-14	Mar-14	Apr-14	May-14	Jun-14	Jul-14	Aug-14	Sep-14
LOXA104	28	19	35	28	38	25	17	14	31	23	21	20
LOXA115	23	17	36	22	36	-	11	U	22	26	20	20
LOXA129	-	24	32	39	45	28	42	34	33	39	26	25
LOXA132	-	26	32	45	41	30	30	24	29	39	26	26
LOXA135	37	29	40	47	38	33	34	25	31	24	24	24
MAX	37	29	40	47	45	33	42	34	33	39	26	26
MIN	23	17	32	22	36	25	11	14	22	23	20	20

U indicates that compound was analyzed, but the concentration was below the minimum detection limit.

Table 2. October 2013 – September 2014 conductivity sonde deployment information, separated by transect, for the A.R.M. Loxahatchee National Wildlife Refuge. X = data collected from sonde deployment during that month. Graphical representation of station locations are shown in Figure 1. Stations labeled DECOM were decommissioned.

	2013	2014										
Site ID	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
LOXA104	X	X		X	X	X	X	X	X	X	X	X
LOXA105	X		X		X		X		X		X	
LOXA106	X		X		X		X		X		X	
LOXA107	X		X		X		X		X		X	
LOXA108	X		X		X		X		X		X	
LOXA111	DECOM-->											
LOXA112	DECOM-->											
LOXA113	DECOM-->											
LOXA114	DECOM-->											
LOXA115	X	X		X	X	X	X	X	X	X	X	X
LOXA116	X		X		X	X	X	X			X	
LOXA117	X		X		X		X		X		X	
LOXA118	X		X		X		X		X		X	
LOXA119	X		X		X		X		X		X	
LOXA120	X		X		X		X		X		X	
LOXA126	DECOM-->											
LOXA127	DECOM-->											
LOXA128	DECOM-->											
LOXA129	X	X		X	X	X	X	X	X	X	X	X
LOXA130	X		X		X		X		X		X	
LOXA131	X		X		X		X		X		X	
LOXA132	X	X		X	X	X	X	X	X	X	X	X
LOXA133	X		X		X		X		X			X
LOXA135	X		X		X	X	X	X	X	X	X	X
LOXA136	X		X		X		X		X		X	
LOXA137	X		X		X		X		X		X	
LOXA138	X		X		X		X		X		X	
LOXA139	X		X		X		X		X		X	
LOXA142	X		X		X	X	X	X	X	X	X	X
LOXA143	X		X		X	X	X	X		X		X
LOXA144	X		X		X	X	X	X		X		X
LOXA145	X		X		X	X	X	X		X		X
LOXA146	X		X		X	X	X	X		X		X
LOXA147	X	X	X	X	X	X	X	X	X	X	X	X
LOXA148	X		X		X	X	X	X		X		X
LOXA149	X		X		X		X	X		X		X
LOXA150	X		X		X		X	X		X		X
LOXA151	X		X		X	X	X	X		X	X	X
LOXA152	X		X		X	X	X	X		X	X	X
LOXA153	X		X		X	X	X	X		X	X	X
I-8C	X	X	X	X	X	X	X	X	X	X	X	X
LOX04	X		X		X		X		X		X	
LOX06	DECOM-->											
LOX07	DECOM-->											
LOX08	DECOM-->											
LOX09	DECOM-->											
LOX10	DECOM-->											
LOX15	X		X		X	X		X		X		X

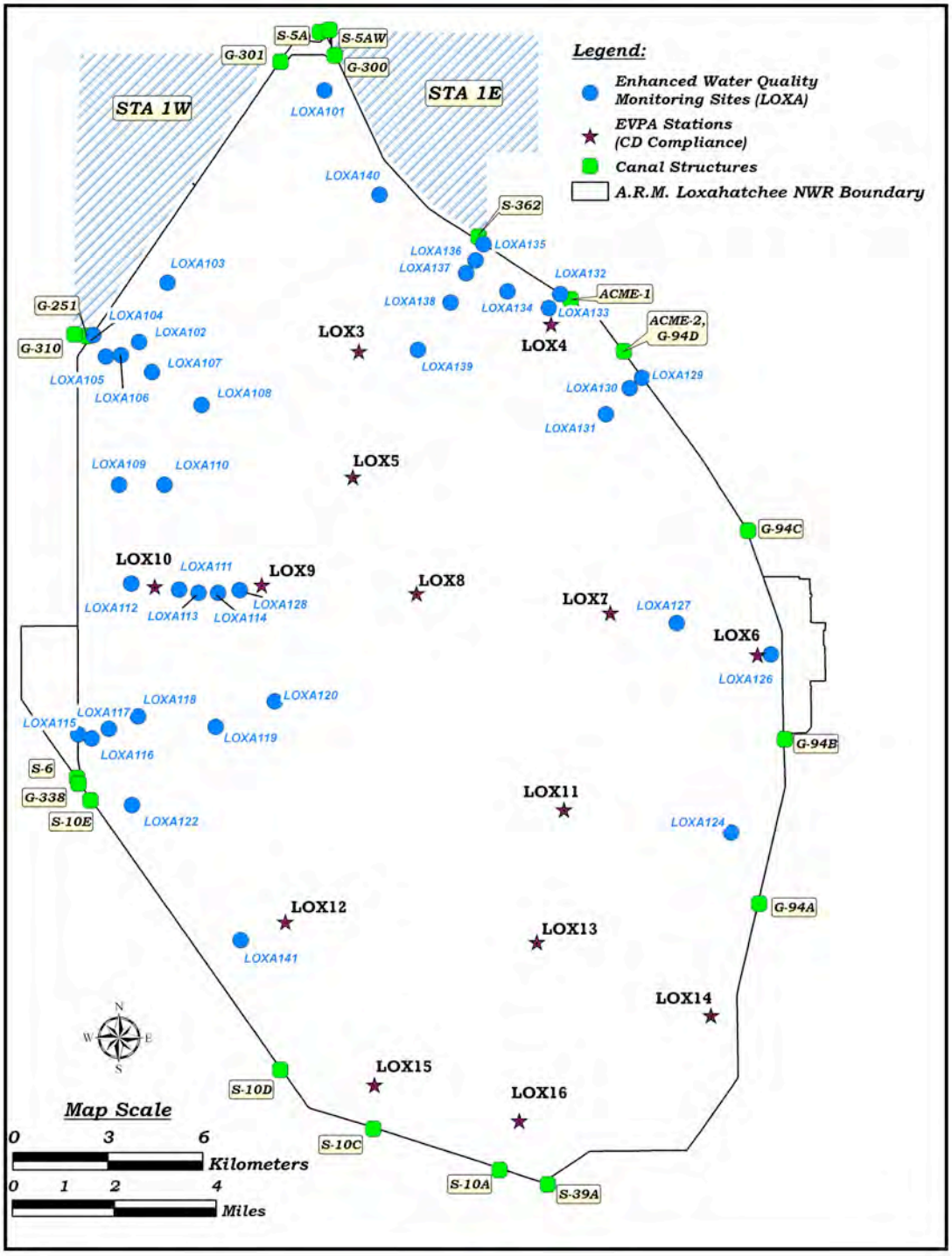

Figure 1. Location of Enhanced Water Quality Monitoring network stations (LOXA###), in relation to Consent Decree compliance stations (LOX##), for the A.R.M. Loxahatchee National Wildlife Refuge.

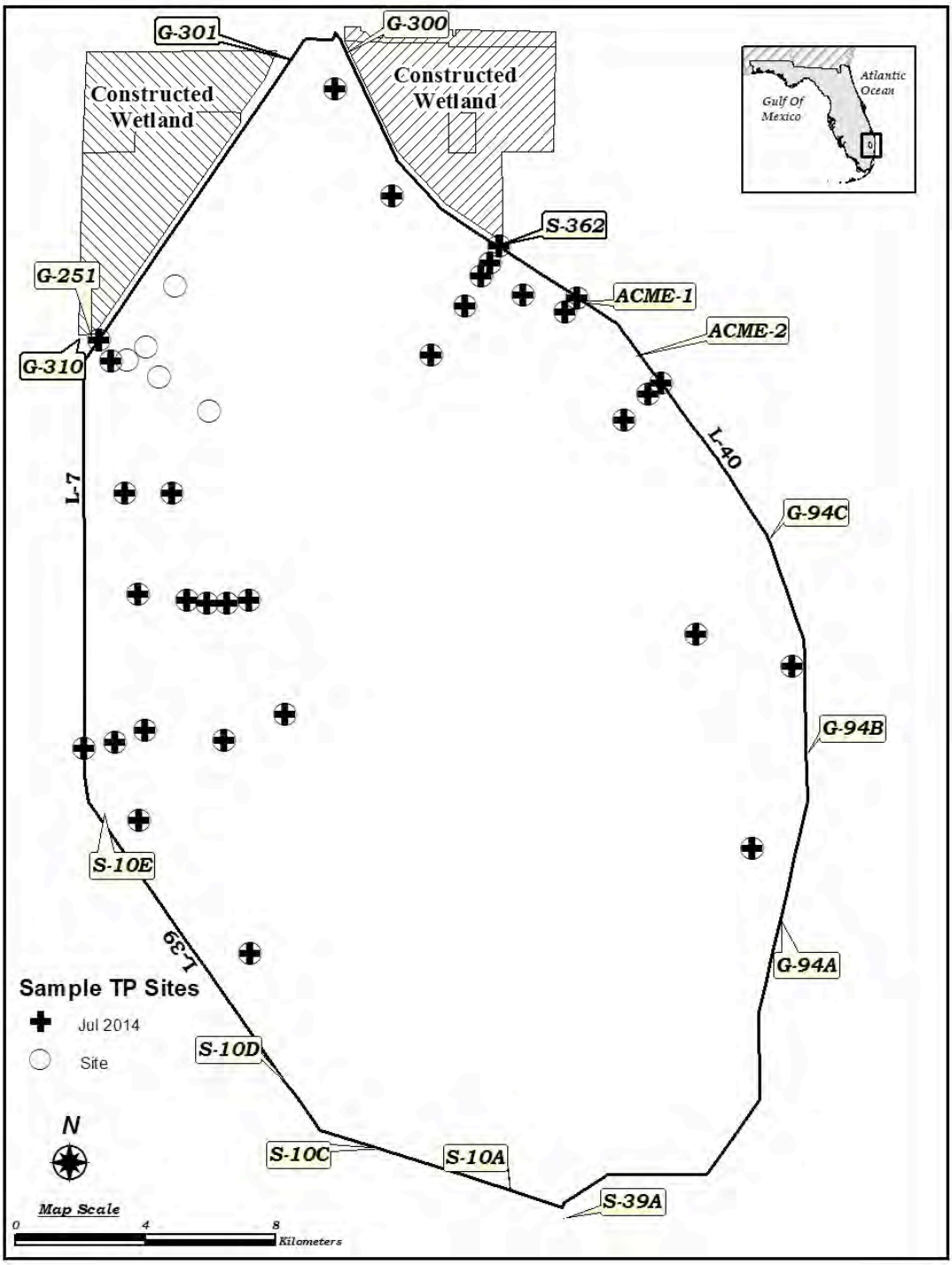

Figure 2. July 2014 map of total phosphorus sample collections from the Enhanced Water Quality Monitoring and the EVPA stations in the A.R.M. Loxahatchee National Wildlife Refuge. A primary reason that a station is not sampled is that it has less than 10 cm of clear water column representative of that area.

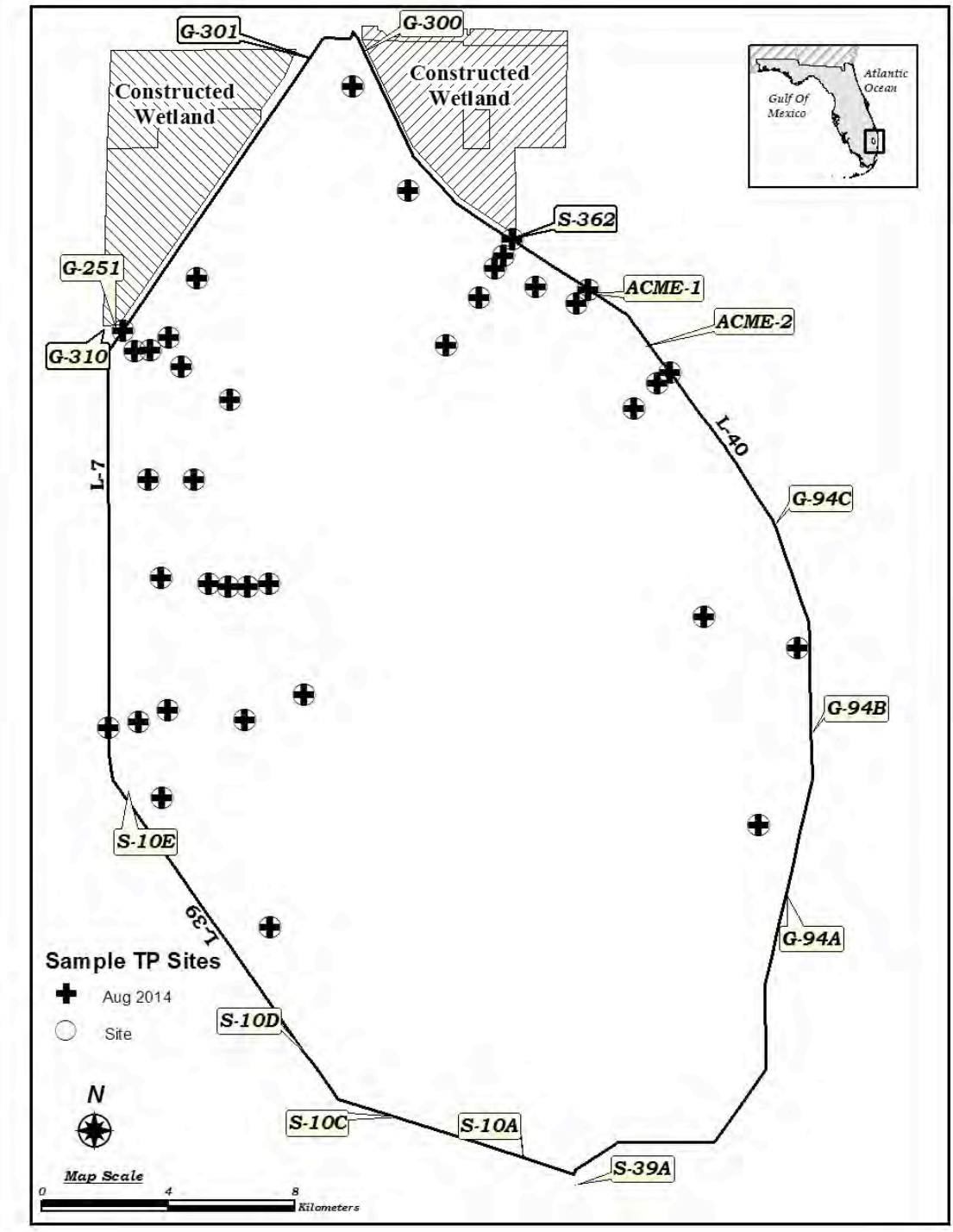

Figure 3. August 2014 map of total phosphorus sample collections from the Enhanced Water Quality Monitoring and the EVPA stations in the A.R.M. Loxahatchee National Wildlife Refuge. A primary reason that a station is not sampled is that it has less than 10 cm of clear water column representative of that area.

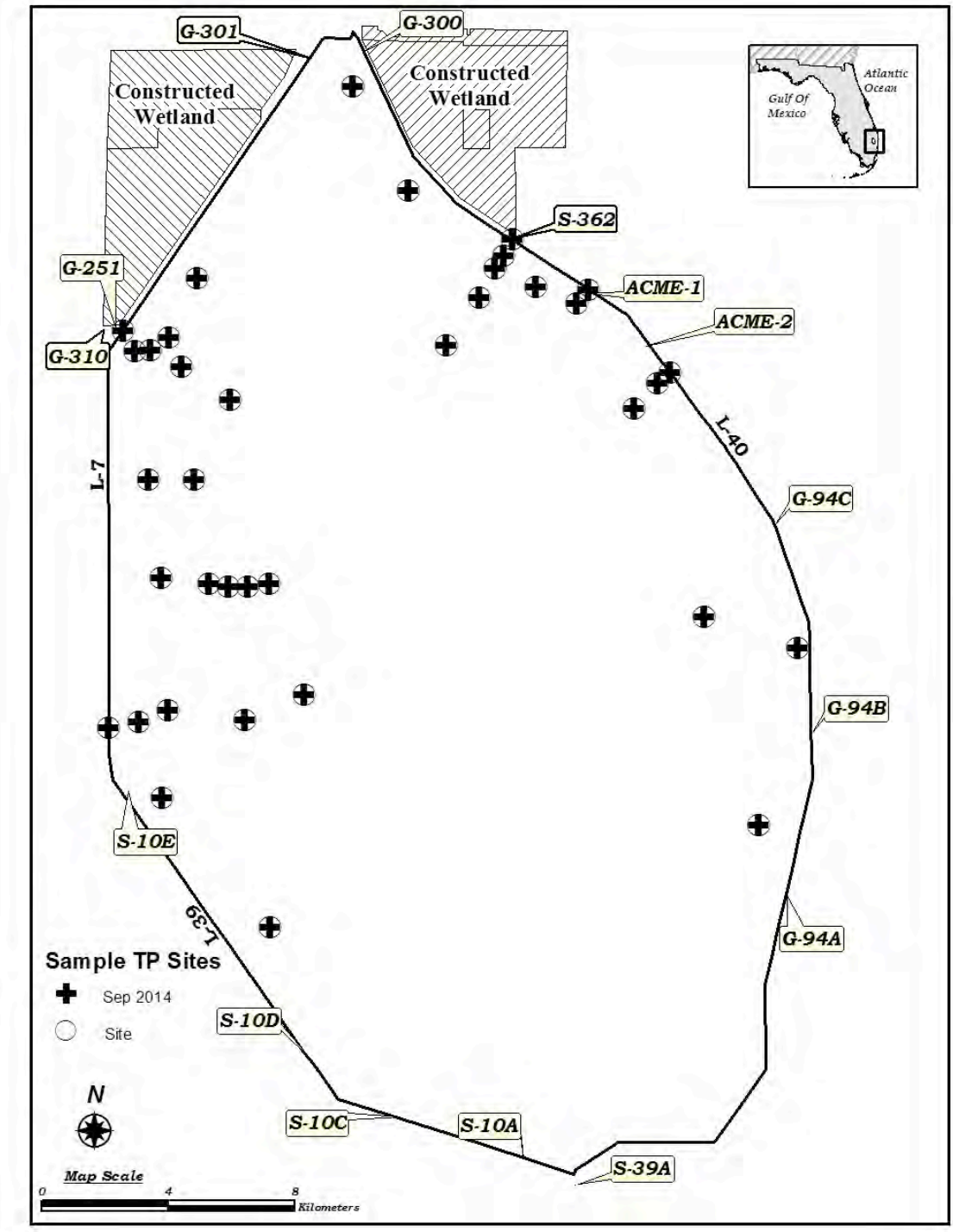

Figure 4. September 2014 map of total phosphorus sample collections from the Enhanced Water Quality Monitoring and the EVPA stations in the A.R.M. Loxahatchee National Wildlife Refuge. A primary reason that a station is not sampled is that it has less than 10 cm of clear water column representative of that area.